Transition Work: Chemistry A level

Meadowhead School and Sixth Form

We make a difference

The step up from GCSE to A level Chemistry is large and we would like everyone to get off to a good start by doing a bit of preparation and revisiting some key skills (chemistry and maths) from GCSE.

Please make sure that you have completed this booklet and hand it in to your chemistry teacher in your first lesson in September.

Contents:

Name: _____

Charges on ions

Task 1:

Learn the formulas of the ions in the table below:

<table>
<tr><td colspan="2">Positive ions</td><td colspan="2">Negative ions</td></tr>
<tr><td>Group 1 ions:
Lithium, Li^+
Sodium, Na^+
Potassium, K^+</td><td rowspan="2">Group 3 ions:
Aluminium, Al^{3+}

Other common ions:
Silver, Ag^+
Zinc, Zn^{2+}
Ammonium, NH_4^+
Hydrogen, H^+</td><td>Group 7 ions:
Fluoride, F^-
Chloride Cl^-
Bromide Br^-
Iodide I^-</td><td rowspan="2">Other common ions:
Nitrate, NO_3^-
Sulfate, SO_4^{2-}
Carbonate, CO_3^{2-}
Hydrogencarbonate, HCO_3^-
Hydroxide, OH^-
Hydride, H^-
Phosphate, PO_4^{3-}</td></tr>
<tr><td>Group 2 ions:
Magnesium, Mg^{2+}
Calcium Ca^{2+}
Barium Ba^{2+}</td><td>Group 6 ions:
Oxide, O^{2-}
Sulphide, S^{2-}</td></tr>
</table>

Task 2: Working out Formulas of Ionic Compounds

Use the charges on the ions to work out the formulas of the ionic compounds listed below:

1) silver bromide ……

2) sodium carbonate ……

3) potassium oxide ……

4) iron (III) oxide ……..

5) chromium (III) chloride ……

6) calcium hydroxide ……

7) aluminium nitrate ……

8) sodium sulfate …….

9) lead (II) oxide ……..

10) sodium phosphate …….

11) zinc hydrogencarbonate ……

12) ammonium sulphate ……

13) gallium hydroxide ……

14) strontium selenide ……

15) radium sulfate …….

16) sodium nitride …….

Task 3: Balancing Equations

You will have already learnt how to balance chemical equations. However, at A level, you will often need to:

- work out the formulas yourselves
- work out what is made (so you need to know some basic general equations)
- for reactions involving ions in solution, write ionic equations

Here are some general reactions you should know:

General Reaction	Examples
substance + oxygen → oxides	$2\ Mg + O_2 \rightarrow 2MgO$ $2\ H_2S + 3\ O_2 \rightarrow 2\ H_2O + 2\ SO_2$ $C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$
metal + water → metal hydroxide + hydrogen	$2\ Na + 2\ H_2O \rightarrow 2\ NaOH + H_2$
metal + acid → salt + hydrogen	$Mg + 2\ HCl \rightarrow MgCl_2 + H_2$
oxide + acid → salt + water	$MgO + 2\ HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$
hydroxide + acid → salt + water	$2\ NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
carbonate + acid → salt + water + carbon dioxide	$CuCO_3 + 2\ HCl \rightarrow CuCl_2 + H_2O + CO_2$
hydrogencarbonate + acid → salt + water + carbon dioxide	$KHCO_3 + HCl \rightarrow KCl + H_2O + CO_2$
ammonia + acid → ammonium salt	$NH_3 + HCl \rightarrow NH_4Cl$
metal carbonate → metal oxide + carbon dioxide (on heating)	$CaCO_3 \rightarrow CaO + CO_2$

1) Balance the following equations.

$$Mg + HNO_3 \rightarrow Mg(NO_3)_2 + H_2$$

$$CuCl_2 + NaOH \rightarrow Cu(OH)_2 + NaCl$$

$$SO_2 + O_2 \rightarrow SO_3$$

$$C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$$

2) Give balanced equations for the following reactions.

a) sodium + oxygen → sodium oxide

b) aluminium + chlorine → aluminium chloride

c) calcium + hydrochloric acid → calcium chloride + hydrogen

d) ammonia + sulphuric acid → ammonium sulphate

Atomic Number, Mass Number and Isotopes

Task 4:

Complete the following passages and the table:

Atomic number = number of ……..

Mass number = number of ……. + number of ……..

The number of protons, neutrons and electrons in an atom can be worked out using the atomic number and mass number.

Atoms of the same element have the same number of..... In fact, it is the number of …… that determines what type of atom it is (e.g. all atoms with 6 protons are carbon atoms). Atoms of different elements have different numbers of ……. . **Isotopes** are atoms with the same number of.....but a different number of.....This means they are atoms of the same …….. with the same ……. number but a different..... number.

Atom	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons
$^{23}_{11}Na$					
Li	3	7			
Ar		40	18		
K			19	20	
Al				14	13
$^{235}_{92}U$					
$^{238}_{92}U$					

Structure and Bonding

Key ideas from structure and bonding at GCSE will be revised and developed in term 1. Make sure you are confident with concepts from GCSE.

The three main types of bonding are:

- Covalent bonding – between two non metal atoms
- Ionic bonding – between metal and non metal atoms
- Metallic bonding – between two metal atoms

Task 5:

Describe the bonding in the following elements/compounds and explain your reasoning.

1. Magnesium
2. Diamond
3. Water
4. Magnesium oxide
5. Carbon dioxide
6. Graphite
7. Sodium nitrate
8. Silicon dioxide
9. Sulphur dioxide
10. Potassium bromide

Task 6:

Draw dot and cross diagrams to represent the covalent bonding in the following molecules:

a) CH_4

b) NH_3

c) HCl

d) O_2

e) CO_2

f) N_2

Task 7:

a) Draw diagrams to show how a magnesium atom reacts with an oxygen atom to form magnesium oxide, MgO. Your diagram should show the electron transfer process.

b) Draw diagrams to show how a calcium atom reacts with chlorine atoms to form magnesium oxide, $CaCl_2$. Your diagram should show the electron transfer process.

Essential Maths skills for A Level chemistry

Significant figures

A significant figure is any digit which you are confident is correct. A non-significant figure is any digit that you can't be sure about. It's important to recognise how many significant figures a value has been quoted to and how to round your own data to an appropriate number of significant figures.

Remember:

- Count the number of significant figures from the first non-zero digit.
- Zeros at the start of a number are not significant.
  So: 187.23 is given to 5 s.f.
  0.038 is given to 2 s.f.
  448 000 is given to 3 s.f.
- The rule for significant figures in calculations is to give your final answer to the same number of significant figures as the data value with the **fewest** significant figures used in the calculation. It may say something like 'round to the appropriate number of significant figures'.

Task 8:

1. How many significant figures are each of these values given to?

a) 221 985 Pa ……..

b) 15 200 g ……..

c) 39.00 K ……

d) 0.00186 mol ……..

2. Write each of the following to the number of significant figures shown:

a) 345789 4 sig figs …… d) 6.0961 3 sig figs ……..

b) 297300 3 sig figs ……. e) 0.001563 3 sig figs …….

c) 0.07896 3 sig figs …… ……. f) 0.010398 4 sig figs ……. ……

3. Complete the following sums and give the answers to the appropriate number of significant figures.

a) 6125 x 384 ……..

b) 25.00 x 0.01 0 ……..

c) 13.5 + 0.18 ……

Example: Exam style question

4. 0.175 moles of sodium chloride were dissolved in 1.2 dm^3 of water.

Use the formula concentration (mol dm^{-3}) = moles/volume (dm^3) to calculate the concentration of the solution, and quote your answer to the correct number of significant figures.

……

……

……

Standard form

Standard form tidies up very big or very small numbers in calculations.

For example, there are 602 000 000 000 000 000 000 000 particles in 1 mole. This is much easier to write as 6.02×10^{23}

Or 0.0051 m^3 is easier to write as 5.1×10^{-3} m^3

Task 9:

Write the following in standard form:

1. 0.000 035 mol/dm^3 ……
2. 201500 Pa ……
3. 0.0167 moles ……
4. 6850000000 dm^3 ……
5. 0.000000382 g ……

Complete the following calculations and give the answers to the appropriate number of significant figures.

a) $6.125 \times 10^{-3} \times 3.5$ ……

b) $4.3 \times 10^{-4} \div 7.00$ ……

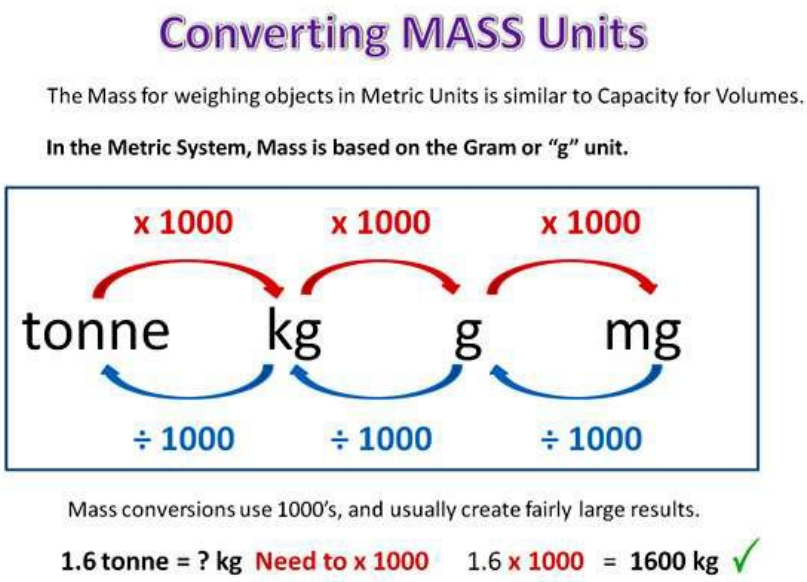
c) $4.0 \times 10^{8} + 35000$ ……

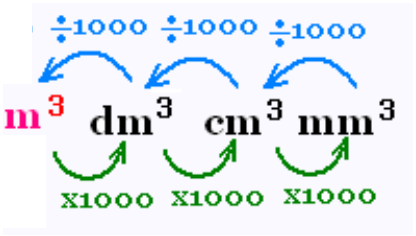
d) $0.00156 + 2.4 \times 10^{3}$ ……

e) $6.10 \times 10^{-2} - 3.4 \times 10^{-5}$ ……

f) $8.00 \times 10^{-3} \times 0.100 \times 10^{-3}$ ……

Converting units





Task 10:

Convert the following units :

1. 10 kg into g ……
2. 360 mg into g ……
3. 360 cm into m ……
4. 360 cm^3 into m^3 ……
5. 250 cm^3 into dm^3 ……
6. 2 dm^3 into mm^3 ……
7. 42357 g into mg ……
8. 4.1 kJ mol^{-1} to J mol^{-1} ……
9. During a titration, 31 cm^3 of an alkali is needed to neutralise 0.025 dm^3 of an acid.
   What is the total volume of the acid and alkali in cm^3? ……
10. What is the total mass, in grams, of 137 mg, 4g and 32kg?
    ……

AQA

The Periodic Table of Elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[294] Ts tennessine 117	[294] Og oganesson 118

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.